# engineering fracture mechanics

**List of Contents and Author Index**
**Volume 39, 1991**

PERGAMON PRESS

OXFORD · NEW YORK · SEOUL · TOKYO

# engineering fracture mechanics

An International Journal



**EDITOR-IN-CHIEF**

**PROFESSOR HAROLD LIEBOWITZ**

School of Engineering and Applied Science,
The George Washington University,
Washington, DC 20052, U.S.A.



**EDITORIAL ADVISORY BOARD**

**PROFESSOR S. N. ATLURI**
Georgia, U.S.A.
**DR. ZDENEK BILEK**
Brno, Czechoslovakia
**PROFESSOR BRUNO A. BOLEY**
New York, U.S.A.
**DR. DAVID BROEK**
Ohio, U.S.A.
**PROFESSOR JANNE CARLSSON**
Stockholm, Sweden
**PROFESSOR G. P. CHEREPANOV**
Moscow, U.S.S.R.
**PROFESSOR H. T. CORTEN**
Illinois, U.S.A.
**DR. J. R. DAVIDSON**
Virginia, U.S.A.
**DR. THEODOR GAYMANN**
Munich, Federal Republic of Germany
**DR. GEORGE T. HAHN**
Ohio, U.S.A.
**PROFESSOR GEORGE HERRMANN**
California, U.S.A.
**PROFESSOR D. L. JONES**
Washington, D.C., U.S.A.
**PROFESSOR HIROSHI KIHARA**
Tokyo, Japan
**DR. J. M. KRAFFT**
Virginia, U.S.A.
**PROFESSOR FRANK A. McCLINTOCK**
Massachusetts, U.S.A.
**DR. HENRI P. van LEEUWEN**
Amsterdam, The Netherlands
**PROFESSOR A. J. McEVILY**
Connecticut, U.S.A.
**PROFESSOR JAROSLAV NEMEC**
Prague, Czechoslovakia
**DR. NICHOLAS PERRONE**
Maryland, U.S.A.
**DR. Y. RAJAPAKSE**
Virginia, U.S.A.
**DR. J. SCHIJVE**
Delft, The Netherlands
**DR. WALTER SCHUTZ**
Ottobrunn, Federal Republic of Germany
**PROFESSOR GEORGE C. SIH**
Pennsylvania, U.S.A.
**PROFESSOR JAN-HAN YANG**
Washington, D.C., U.S.A.
**PROFESSOR TAKEO YOKOBORI**
Sendai City, Japan
**ROBERT E. ZINKHAM**
Virginia, U.S.A.



**Publishing, Subscription and Advertising Offices:** Pergamon Press plc, Headington Hill Hall, Oxford OX3 0BW, England; or Pergamon Press Inc., 395 Saw Mill River Road, Elmsford, NY 10523, U.S.A.

**Annual Subscription Rates (1991)**
Annual Institutional subscription rate (1991) DM 2865.00. Two year institutional rate (1991/92) DM 5443.50. Personal subscription rate for those whose library subscribes at the regular rate (1991) is available on request. Prices are subject to change without notice. Subscription rates for Japan include despatch by air and prices are available on application.

**Published 18 Times Per Annum** (Three volumes 1991). Subscription enquiries from customers in North America should be sent to Pergamon Press Inc., 395 Saw Mill River Road, Elmsford, NY 10523, U.S.A. and for the remainder of the world to Pergamon Press plc, Headington Hill Hall, Oxford OX3 0BW, England.

**Back Issues** of all previously published volumes, in both hard copy and on microform are available direct from Pergamon Press offices.



**Copyright © 1991 Pergamon Press plc.**

It is a condition of publication that manuscripts submitted to this journal have not been published and will not be simultaneously submitted or published elsewhere. By submitting a manuscript, the authors agree that the copyright for their article is transferred to the publisher if and when the article is accepted for publication. However, assignment of copyright is not required from authors who work for organisations which do not permit such assignment. The copyright covers the exclusive rights to reproduce and distribute the article, including reprints, photographic reproductions, microform or any other reproductions of similar nature and translations. No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means electronic, electrostatic, magnetic tape, mechanical photocopying, recording or otherwise, without permission in writing from the copyright holder.

Whilst every effort is made by the publishers and editorial board to see that no inaccurate or misleading data, opinion or statement appears in this journal, they wish to make it clear that the data and opinions appearing in the articles and advertisements herein are the sole responsibility of the contributor or advertiser concerned. Accordingly, the publishers, the editorial board and editors and their respective employees, officers and agents accept no responsibility or liability whatsoever for the consequences of any such inaccurate or misleading data, opinion or statement.

♾™ The text paper used in this publication meets the minimum requirements of American National Standard for Information Sciences—Permanence of Paper for Printed Library Materials, ANSI Z39.48-1984.

*Photocopying information for users in the U.S.A.* The Item-Fee code for this publication indicates that authorization to photocopy items for internal or personal use is granted by the copyright holder for libraries and other users registered with the Copyright Clearance Center (CCC) Transactional Reporting Service provided the stated fee for copying beyond that permitted by Section 107 or 108 of the United States Copyright Law is paid. The appropriate remittance of $3.00 per copy per article is paid directly to the Copyright Clearance Center Inc., 27 Congress Street, Salem, MA 01970.

*Permission for other use*. The copyright owner's consent does not extend to copying for general distribution, for promotion, for creating new works, or for resale. Specific written permission must be obtained from the publisher for such copying.



*The Item-Fee Code for this publication is:* 0013-7944/91 $3.00 + .00


The cover picture was taken by Dr. Erwin Sommer in his studies at the Ernst Mach Institute in Freiburg, Germany, in work under the direction of Dr. F. Kerkhof. Dr. Sommer is Director of Fraunhofer-Institut Fuer Werkstoffmechanik, Rosastraße, 9, 7800 Freiburg, Germany.

# List of Contents

## NUMBER 1


| | | |
|---|---|---|
| **C. L. Chow** and **T. J. Lu** | 1 | Cyclic $J$-integral in relation to fatigue crack initiation and propagation |
| **S. Hirose** and **J. D. Achenbach** | 21 | Acoustic emission and near-tip elastodynamic fields of a growing penny-shaped crack |
| **Y. W. Shi, J. T. Barnby** and **A. S. Nadkarni** | 37 | Void growth at ductile crack initiation of a structural steel |
| **F. Delale** and **H. Boduroglu** | 45 | Effect of thermal expansion anisotropy on micro-cracking in ceramic composites |
| **Chen Jin-De, Wang Yu-Wei** and **Yu De-Hong** | 61 | The controlled fracture technique and its application in metalworking |
| **P. S. Theocaris** | 71 | The distortion of the shape of reflected caustics in birefringent materials |
| **P. S. Theocaris** and **C. Lazopoulos** | 83 | Higher-order forms of caustics in mixed-mode fracture |
| **Wen Pi-Hua** | 93 | The general conclusions of stress intensity factors for the cracks at the interface between two different orthotropic media |
| **R. P. Ojdrovic** and **H. J. Petroski** | 105 | Weight functions from multiple reference states and crack profile derivatives |
| **R. C. McClung** and **D. L. Davidson** | 113 | High resolution numerical and experimental studies of fatigue cracks |
| **J. R. Matthews** | 131 | On the relationship between shear index and energy in dynamic tear specimens |
| **Ling Chaoxi** and **W. Suaris** | 141 | Hadamard's principle for displacement discontinuity modeling of cracks |
| **K. Rajanna, B. H. Kolster** and **B. Pathiraj** | 147 | Fatigue fracture surface analysis in C45 steel specimens using X-ray fractography |
| **K. Hollmann** | 159 | Failure analysis of a shear loaded graphite/epoxy beam containing an irregular cutout |
| | I | Software Survey Section |


## NUMBER 2


| | | |
|---|---|---|
| **A. Carpinteri** | 177 | Energy dissipation in R. C. beams under cyclic loadings |
| **F. P. Chiang, B. C. Liu** and **S. Li** | 185 | Deformation fields around stable growing crack tips in aluminum |

| | | |
|---|---|---|
| **M. Heller, R. Jones** and **J. F. Williams** | 195 | Analysis of cold-expansion for cracked and uncracked fastener holes |
| **H. W. Liu, Qi Chen** and **S. K. Sinha** | 213 | The characterization of a crack-tip field |
| **Qingfen Li, Shenghai Hu, Boming Zhong** and **Jiaquan Wei** | 219 | A further study about the effect of crack depth and shape on fracture toughness |
| **X. S. Zhang** | 229 | The general solution to an infinite orthotropic plate with a cruciform crack under arbitrary anti-plane shear stresses |
| **X. S. Zhang** | 235 | Fermat's Last Theorem proved by a simple method |
| **J. W. Mills** and **F. H. Huang** | 241 | Delayed hydride cracking behavior for Zircaloy-2 plate |
| **Li-Hau Peng, Wei Shen, C. L. Chow** and **A. Asundi** | 259 | Damage field and its evolution in a glass-fiber cloth/epoxy composite plate with a central hole |
| **T. K. Hellen** | 269 | Numerical post-yield fracture criteria comparisons on plane strain test specimens |
| **Dai-Heng Chen** and **Hironobu Nisitani** | 287 | Analysis of the delaying effects of overloads on fatigue crack propagation |
| **Jiang Chi-Ping** | 299 | The plane problem of collinear rigid lines under arbitrary loads |
| **M. Ben-Amoz** | 309 | A cumulative damage theory for creep and creep–fatigue interaction |
| **A. S. M. Israil** and **G. F. Dargush** | 315 | Dynamic fracture mechanics studies by time-domain BEM |
| **A. Neimitz** | 329 | Analysis of the crack motion with varying velocity according to the Dugdale–Panasyuk model |
| **S. R. Mettu** and **K. S. Kim** | 339 | An application of the time-domain boundary integral equation method to dynamic crack propagation |
| **Da Yu Tzou** and **Er-Ping Chen** | 347 | Mesocrack damage induced by a macrocrack in heterogeneous materials |
| **J. Toribio, V. Sanchez-Galvez, M. A. Astiz** and **J. M. Campos** | 359 | Stress intensity factor solutions for a cracked bolt under tension, bending and residual stress loading |
| **M. O. Lai** | 373 | $K_{IC}$ determination—a non-standard approach |
| **G. Frantziskonis, F. F. Tang** and **C. S. Desai** | 377 | Borehole scale effects and related instabilities |

| | | |
|---|---|---|
| **D. Radaj** and **S. Zhang** | 391 | Stress intensity factors for spot welds between plates of unequal thickness |
| **L. Olaosebikan** | 415 | On the crack-tip displacement field in finite-sized plates |
| **H. C. M. Chan** | 433 | Equivalent crack formation by propagating cracks under tension |
| | I | Software Survey Section |


## NUMBER 3


| | | |
|---|---|---|
| **J. M. Koo** and **Y. S. Choy** | 443 | A new mixed mode fracture criterion: maximum tangential strain energy density criterion |
| **M. A. Aminpour** and **K. A. Holsapple** | 451 | Finite element solutions for propagating interface cracks with singularity elements |
| **Li Yuechuan** | 469 | The application of the Gurtin variational principle in the computation of dynamic stress intensity factors |
| **N. A. B. Yehia** | 477 | Distortional strain energy density criterion: the *Y*-criterion |
| **S. Itou** | 487 | Transient dynamic stresses around a rectangular crack under an impact shear load |
| **G. G. Chen** and **T. R. Hsu** | 493 | The role of plastic strains in creep crack growth |
| **G. G. Chen** and **T. R. Hsu** | 509 | Effects of cyclic plasticity on creep crack growth |
| **A. Aksoy** and **L. A. Carlsson** | 525 | Crack tip yield zone estimates in mode II interlaminar fracture of interleaved composites |
| **M. T. Kirk** and **R. H. Dodds, Jr** | 535 | An analytical and experimental comparison of $J_i$-values for shallow through and part-through surface cracks |
| **E. P. Chen** | 553 | Continuum damage response of a center-cracked plain concrete panel in tension |
| **A. Kaczyński** and **S. J. Matysiak** | 561 | On the stress distribution in a periodic reinforced elastic composite with partially unbonded fiber |
| **Z. Mei** and **J. W. Morris, Jr** | 569 | Analysis of transformation-induced crack closure |
| **C. Hsu** and **C. E. Albright** | 575 | Fatigue analysis of laser welded lap joints |
| **Wen-Hwa Chen** and **Chin-Cheng Huang** | 581 | Analysis of three-dimensional thermoelastic fracture problems using path-independent integrals |
| **Sham-Tsong Shiue** and **Sanboh Lee** | 591 | Elastic interaction between screw dislocations and collinear edge and internal cracks |

**A. C. Chambers, T. H. Hyde** and **J. J. Webster** 603 Mixed mode fatigue crack growth at 550°C under plane stress conditions in Jethete M152

*Letter to the Editor*
**J. Schijve** 621 Comments on the Technical Note: The relationship between the parameters *C* and *n* of Paris' law for fatigue crack growth in a SAE 1010 steel

I Software Survey Section

**NUMBER 4**

**Xiang Qiao Yan, Shan Yi Du** and **Duo Wang** 623 An engineering method of determining the delamination fracture toughness of composite laminates

**T. Ogawa** and **S. Suresh** 629 Surface film technique for crack length measurement in nonconductive brittle materials: calibration and evaluation

**C. Poette** and **S. Albaladejo** 641 Stress intensity factors and influence functions for circumferential surface cracks in pipes

**Wen Pi-Hua** and **Wang Yu** 651 The calculation of SIF considering the effects of arc crack surfaces contact and friction under uniaxial tension and pressure

**K. Nakasa** and **J.-I. Nakatsuka** 661 Crack initiation, propagation and branching in a disk of brittle material under axisymmetric tension

**E. E. Gdoutos, M. A. Kattis, V. K. Argyrokosta, T. J. Koutsougeras** and **M. C. Papanelopoulou** 671 Two circular-arc cracks in an infinite elastic plate

**Zhao Yishu** 683 Behaviour and criterion of quasi-brittle fracture of metals

**De Huan Li** and **Wei Hua Tai** 687 Elastodynamic response of an interface crack in a layered composite under anti-plane shear impact load

**M. Kamel** and **B. M. Liaw** 695 Boundary element formulation with special kernels for an anisotropic plate containing an elliptical hole or a crack

**Junbiao Lai, Xing Zhang** and **J. Schijve** 713 An investigation of a hole-edge crack problem by a combined complex variable and least square method

**E. Tschegg, H. O. K. Kirchner** and **M. Kocak** 739 Interfacial and subinterfacial cracks in the copper–ferrite system

**M. Ichikawa** 751 Stress state dependence of the shape parameter of the three-parameter Weibull distribution in relation to fracture of ceramics

| | | |
|---|---|---|
| **T. Nishioka, T. Murakami, H. Uchiyama, K. Sakakura** and **H. Kittaka** | 757 | Specimen size effects on dynamic crack propagation and arrest in DCB specimens |
| **A. Lundström** and **J. Tryding** | 769 | A low cycle fatigue criterion based on non-linear fracture mechanics |
| | | *Announcement* |
| | 783 | 2nd International Conference, Computer Aided Assessment and Control, Localized Damage, Southampton, U.K., 1–3 July 1992 |
| | I | Software Survey Section |

**NUMBER 5**

| | | |
|---|---|---|
| **L. F. Mannion** | 785 | Dynamic fracture of a tapered idealized fiber-reinforced cantilever |
| **Y. Z. Chen, D. Gross** and **Y. J. Huang** | 791 | Numerical solution of the curved crack problem by means of polynomial approximation of the dislocation distribution |
| **Sun Jun** | 799 | Effect of stress triaxiality on micro-mechanisms of void coalescence and micro-fracture ductility of materials |
| **S. A. Liu** and **F. A. Cozzarelli** | 807 | Strain-controlled creep rupture in an internally-notched pressurized tube by the finite element technique |
| **J. Fernández Sáez, J. Chao, J. M. Amo** and **J. Durán** | 823 | Stress and strain fields ahead of a crack in ductile materials. Application to approximate evaluation of fracture ductility and fracture toughness |
| **J. Chao, J. Fernández Sáez, J. M. Amo** and **J. Durán** | 833 | An experimental investigation of blunting and stable crack growth processes of a crack in the weld HAZ |
| **M. Isida, T. Yoshida** and **H. Noguchi** | 845 | Parallel array of semi-elliptical surface cracks in semi-infinite solid under tension |
| **K. S. Zhang** and **C. Q. Zheng** | 851 | Analysis of large deformation and fracture of axi-symmetric tensile specimens |
| **K. S. Zhang** and **C. Q. Zheng** | 859 | Computer simulation of fracture initiation and crack propagation of TPB specimens |
| **Jiang Bingyuan, Zheng Xitong** and **Wu Lei** | 867 | Estimate by fracture mechanics theory for rolling contact fatigue life and strength of case-hardened gear materials with computer |
| **E. I. Meletis, W. Huang** and **E. E. Gdoutos** | 875 | A study of the three-dimensional region at crack tips by the method of caustics |
| **C. Ihara, T. Yanagi** and **T. Tanaka** | 887 | Estimation of creep life for metals based on damage mechanics |

| | | |
|---|---|---|
| **R. Arone** | 895 | Fatigue crack growth under stationary random load |
| **T. Fett** | 905 | Conditions for the determination of approximate COD fields |
| **Tei-Chen Chen** and **Cheng-I Weng** | 915 | Coupled transient thermoelastic response in an edge-cracked plate |
| **C. R. Chiang** | 927 | Kinked cracks in an anisotropic material |
| | I | Software Survey Section |


**NUMBER 6**


| | | |
|---|---|---|
| **G. Gounaris, N. Anifantis** and **A. D. Dimarogonas** | 931 | Dynamics of cracked hollow beams |
| **N. R. Moody, S. L. Robinson** and **M. W. Perra** | 941 | Internal hydrogen effects on thresholds for crack growth in the iron-based superalloy IN903 |
| **Liu Yongning, Zhu Jinghau** and **Zhou Huijiu** | 955 | The inertia effect in Charpy impact tests |
| **X. C. Yin** and **T. G. Chen** | 965 | Photoelastic investigation of mixed-mode fracture parameters with full-field selected line method |
| **D. Vasilopoulos** | 977 | An algorithm for the eigenvalues of a corner with mixed boundary conditions |
| **B. S. K. Sundarasivarao** and **N. Ganesan** | 1003 | Deformation of varying thickness of conical shells subjected to axisymmetric loading with various end conditions |
| **L. Nobile** | 1011 | Damage mechanics of concrete |
| **C. S. Venkatesha** and **R. Narasimhan** | 1015 | Influence of isotropic strain hardening on plane strain dynamic growth in elastic–plastic materials |
| **C. A. M. Oliveira, F. J. M. Q. de Melo** and **P. M. S. T. de Castro** | 1027 | The elastic analysis of arbitrary thin shells having part-through cracks, using the integrated line spring and the semiloof shell elements |
| **A. A. Khalil** and **M. R. Bayoumi** | 1037 | Effect of loading rate on fracture toughness of bonded joints |
| **Sun Jun, Li Zhong-Hua, Deng Zeng-Jie** and **Tu Ming-Jing** | 1045 | Crack-tip constraint and $J$-controlling stable growth of crack in plane stress case |
| **Sun Jun, Deng Zeng-Jie** and **Tu Ming-Jing** | 1051 | Effect of stress triaxiality levels in crack tip regions on the characteristics of void growth and fracture criteria |
| **R. El Abdi** | 1061 | A special finite element for the analysis of the singularity in a bimaterial containing a crack perpendicular to the interface |

**K. S. Parihar** and **J. V. S. Krishna Rao** 1067 Axially symmetric stress distribution in the neighbourhood of a penny shaped crack under general surface loadings

*Letter to the Editor*

**Xiang Qiao Yan, Shanyi Du** and **Duo Wang** 1097 On numerical simulation techniques of stable crack growth

1099 Corrigenda

I Software Survey Section

i Index to Vol. 39

# Author Index


Achenbach, J. D. 21
Aksoy, A. 525
Albaladejo, S. 641
Albright, C. E. 575
Aminpour, M. A. 451
Amo, J. M. 823, 833
Anifantis, N. 931
Argyrokosta, V. K. 671
Arone, R. 895
Astiz, M. A. 359
Asundi, A. 259

Barnby, J. T. 37
Bayoumi, M. R. 1037
Ben-Amoz, M. 309
Boduroglu, H. 45
Boming Zhong 219

Campos, J. M. 359
Carlsson, L. A. 525
Carpinteri, A. 177
Chambers, A. C. 603
Chan, H. C. M. 433
Chao, J. 823, 833
Chen Jin-De 61
Chen, E. P. 553
Chen, G. G. 493, 509
Chen, T. G. 965
Chen, Y. Z. 791
Cheng-I Weng 915
Chiang, C. R. 927
Chiang, F. P. 185
Chin-Cheng Huang 581
Chow, C. L. 1, 259
Choy, Y. S. 443
Cozzarelli, F. A. 807

Da Yu Tzou 347
Dai-Heng Chen 287
Dargush, G. F. 315
Davidson, D. L. 113
de Castro, P. M. S. T. 1027
De Huan Li 687
de Melo, F. J. M. Q. 1027
Delale, F. 45
Deng Zeng-Jie 1045, 1051
Desai, C. S. 377
Dimarogonas, A. D. 931
Dodds, R. H. Jr 535
Duo Wang 623, 1097
Duran, J. 823, 833

El Abdi, R. 1061
Er-Ping Chen 347

Fernandez Saez, J. 823, 833
Fett, T. 905
Frantziskonis, G. 377

Ganesan, N. 1003
Gdoutos, E. E. 671, 875
Gounaris, G. 931
Gross, D. 791

Hellen, T. K. 269
Heller, M. 195
Hironobu Nisitani 287
Hirose, S. 21
Hollmann, K. 159
Holsapple, K. A. 451
Hsu, C. 575
Hsu, T. R. 493, 509
Huang, F. H. 241
Huang, W. 875
Huang, Y. J. 791
Hyde, T. H. 603

Ichikawa, M. 751
Ihara, C. 887
Isida, M. 845
Israil, A. S. M. 315
Itou, S. 487

Jiang Bingyuan 867
Jiang Chi-Ping 299
Jiaquan Wei 219
Jones, R. 195
Junbiao Lai 713

Kaczynski, A. 561
Kamel, M. 695
Kattis, M. A. 671
Khalil, A. A. 1037
Kim, K. S. 339
Kirchner, H. O. K. 739
Kirk, M. T. 535
Kittaka, H. 757
Kocak, M. 739
Kolster, B. H. 147
Koo, J. M. 443
Koutsougeras, T. J. 671
Krishna Rao, J. V. S. 1067

Lai, M. O. 373
Lazopoulos, C. 83
Li Yuechuan 469
Li Zhong-Hua 1045
Li, S. 185
Li-Hua Peng 259
Liaw, B. M. 695
Ling Chaoxi 141
Liu Yongning 955
Liu, B. C. 185
Liu, H. W. 213
Liu, S. A. 807
Lu, T. J. 1
Lundstrom, A. 769

Mannion, L. F. 785
Matthews, J. R. 131
Matysiak, S. J. 561
McClung, R. C. 113
Mei, Z. 569
Meletis, E. I. 875
Mettu, S. R. 339
Mills, J. W. 241
Moody, N. R. 941
Morris, J. W. Jr 569
Murakami, T. 757

Nadkarni, A. S. 37
Nakasa, K. 661
Nakatsuka, J.-I. 661
Narasimhan, R. 1015
Neimitz, A. 329
Nishioka, T. 757
Nobile, L. 1011
Noguchi, H. 845

Ogawa, T. 629
Ojdrovic, R. P. 105
Olaosebikan, L. 415
Oliveira, C. A. M. 1027

Papanelopoulou, M. C. 671
Parihar, K. S. 1067
Pathiraj, B. 147
Perra, M. W. 941
Petroski, H. J. 105
Poette, C. 641

Qi Chen 213
Qingfen Li 219

Radaj, D. 391
Rajanna, K. 147
Robinson, S. L. 941

Sakakura, K. 757
Sanboh Lee 591
Sanchez-Galvez, V. 359
Schijve, J. 621, 713
Sham-Tsong Shiue 591
Shan Yi Du 623
Shanyi Du 1097
Shenghai Hu 219
Shi, Y. W. 37
Sinha, S. K. 213
Suaris, W. 141
Sun Jun 799, 1045, 1051
Sundarasivarao, B. S. K. 1003
Suresh, S. 629

Tanaka, T. 887
Tang, F. F. 377
Tei-Chen Chen 915
Theocaris, P. S. 71, 83
Toribio, J. 359
Tryding, J. 769
Tschegg, E. 739
Tu Ming-Jing 1045, 1051

Uchiyama, H. 757

Vasilopoulos, D. 977
Venkatesha, C. S. 1015

Wang Yu 651
Wang Yu-Wei 61
Webster, J. J. 603
Wei Hua Tai 687
Wei Shen 259
Wen Pi-Hua 93, 651
Wen-Hwa Chen 581
Williams, J. F. 195
Wu Lei 867

Xiang Qiao Yan 623, 1097
Xing Zhang 713

Yanagi, T. 887
Yehia, N. A. B. 477
Yin, X. C. 965
Yoshida, T. 845
Yu De-Hong 61

Zhang, K. S. 851, 859
Zhang, S. 391
Zhang, X. S. 229, 235
Zhao Yishu 683
Zheng Xitong 867
Zheng, C. Q. 851, 859
Zhou Huijiu 955
Zhu Jinghau 955

Printed in Great Britain by BPCC Wheatons Ltd, Exeter

**Contents** (*continued from outside back cover*)

*Letter to the Editor*

**Xiang Qiao Yan, Shanyi Du** and **Duo Wang** 1097 On numerical simulation techniques of stable crack growth

1099 Corrigenda

I Software Survey Section

i Index to Vol. 39

INDEXED/ABSTRACTED IN: *Appl. Mech. Rev., Current Contents, Cambridge Sci. Abstr., Engng Ind., Monthly & Author Index, INSPEC Database, LLBA, Mechanics, PASCAL-CNRS Data*

**ISSN 0013-7944**

EFMEAH 39(6) 931–1100 (1991)

Published by PERGAMON PRESS

Oxford · New York · Seoul · Tokyo

# Engineering Fracture Mechanics

Volume 39 Number 6 1991

## CONTENTS


| | | |
|---|---|---|
| **G. Gounaris, N. Anifantis** and **A. D. Dimarogonas** | 931 | Dynamics of cracked hollow beams |
| **N. R. Moody, S. L. Robinson** and **M. W. Perra** | 941 | Internal hydrogen effects on thresholds for crack growth in the iron-based superalloy IN903 |
| **Liu Yongning, Zhu Jinghau** and **Zhou Huijiu** | 955 | The inertia effect in Charpy impact tests |
| **X. C. Yin** and **T. G. Chen** | 965 | Photoelastic investigation of mixed-mode fracture parameters with full-field selected line method |
| **D. Vasilopoulos** | 977 | An algorithm for the eigenvalues of a corner with mixed boundary conditions |
| **B. S. K. Sundarasivarao** and **N. Ganesan** | 1003 | Deformation of varying thickness of conical shells subjected to axisymmetric loading with various end conditions |
| **L. Nobile** | 1011 | Damage mechanics of concrete |
| **C. S. Venkatesha** and **R. Narasimhan** | 1015 | Influence of isotropic strain hardening on plane strain dynamic growth in elastic–plastic materials |
| **C. A. M. Oliveira, F. J. M. Q. de Melo** and **P. M. S. T. de Castro** | 1027 | The elastic analysis of arbitrary thin shells having part-through cracks, using the integrated line spring and the semiloof shell elements |
| **A. A. Khalil** and **M. R. Bayoumi** | 1037 | Effect of loading rate on fracture toughness of bonded joints |
| **Sun Jun, Li Zhong-Hua, Deng Zeng-Jie** and **Tu Ming-Jing** | 1045 | Crack-tip constraint and $J$-controlling stable growth of crack in plane stress case |
| **Sun Jun, Deng Zeng-Jie** and **Tu Ming-Jing** | 1051 | Effect of stress triaxiality levels in crack tip regions on the characteristics of void growth and fracture criteria |
| **R. El Abdi** | 1061 | A special finite element for the analysis of the singularity in a bimaterial containing a crack perpendicular to the interface |
| **K. S. Parihar** and **J. V. S. Krishna Rao** | 1067 | Axially symmetric stress distribution in the neighbourhood of a penny shaped crack under general surface loadings |


*Continued on inside back cover*

Printed in Great Britain by BPCC Wheatons Ltd, Exeter

Reproduced with the permission of Pergamon Press Inc., by University Microfilms Inc. Duplication or resale without permission is prohibited.